

WHAT IS CLAIMED IS:

1. A method of fabricating an aspherical microstructure, said method comprising the steps of:

(a) forming a protruding microstructure on a substrate;

5 (b) forming an aspherical-profile forming layer on the substrate and the protruding microstructure, an aspherical profile being formed on the protruding microstructure utilizing a surface tension of the aspherical-profile forming layer; and

(c) hardening the aspherical-profile forming layer with the
10 aspherical profile being maintained.

2. The method of claim 1, wherein said step (a) includes a step of preparing the substrate with a conductive portion, a step of forming an insulating mask layer on the conductive portion of the substrate, a step
15 of forming at least one opening in the insulating mask layer to expose the conductive portion at the at least one opening, and a step of forming an electroplated or electrodeposited layer in the opening and about a portion of the insulating mask layer around the opening using electroplating or electrodeposition.

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3. The method of claim 2, wherein the at least one opening has one of a circular shape and a slit shape.

4. The method of claim 2, wherein a plurality of the openings formed
25 in the insulating mask layer have a common shape.

5. The method of claim 2, wherein a plurality of the openings formed

in the insulating mask layer are regularly arranged.

6. The method of claim 2, wherein the electroplated or electrodeposited layer has one of an approximately-semispherical shape and
5 an approximately-semicylindrical shape.

7. The method of claim 2, wherein in said step (b) the aspherical-profile forming layer is formed after the insulating mask layer formed in said step (a) is removed.

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8. The method of claim 1, wherein said step (a) includes a step of forming a reflow layer on the substrate, and a step of performing a reflow-processing of the reflow layer to form the protruding microstructure.

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9. The method of claim 8, wherein the reflow layer subjected to the reflow-processing has one of an approximately-semispherical shape and an approximately-semicylindrical shape.

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10. The method of claim 1, wherein in said step (a) a plurality of the protruding microstructures are formed on the substrate.

11. The method of claim 10, wherein the plurality of the protruding microstructures have a common profile.

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12. The method of claim 10, wherein the plurality of the protruding microstructures are regularly arranged.

13. The method of claim 1, wherein the protruding microstructure has one of an approximately-semispherical shape and an approximately-semicylindrical shape.

5 14. The method of claim 1, wherein in said step (b) the aspherical-profile forming layer is formed using a spin-coat method.

15 15. The method of claim 1, wherein in said step (b) the aspherical-profile forming layer is formed using a dip-coat method.

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16. The method of claim 1, wherein in said step (b) the aspherical-profile forming layer is formed of a plastic material using a chemical vapor deposition (CVD) method.

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17. The method of claim 1, wherein in said step (b) the aspherical-profile forming layer is formed of a plastic material using a chemical vapor deposition (CVD) method, and deformed in a thermoplastic manner.

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18. The method of claim 10, further comprising a step (d) of forming a fly-eye forming layer on the aspherical-profile forming layer to form a fly-eye construction on the plurality of the protruding microstructures.

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19. The method of claim 18, wherein the fly-eye forming layer is formed until a fill-factor of the fly-eye construction reaches approximately 100%.

20. The method of claim 18, wherein in said step (d) the fly-eye forming layer is formed using an electroplating method.

21. The method of claim 18, wherein in said step (d) the fly-eye forming layer is formed using an electroless plating method.

22. The method of claim 18, wherein in said step (d) the fly-eye forming layer is formed using a chemical vapor deposition (CVD) method.

23. The method of claim 1, wherein the substrate, the protruding microstructure, and the aspherical-profile forming layer are formed of transparent material, respectively.

24. A method of fabricating a mold for an aspherical microstructure array, said method comprising the steps of:

(a) forming a protruding microstructure on a substrate;

(b) forming an aspherical-profile forming layer on the substrate and the protruding microstructure, an aspherical profile being formed on the protruding microstructure utilizing a surface tension of the aspherical-profile forming layer; and

(c) hardening the aspherical-profile forming layer with the aspherical profile being maintained.

25. A method of fabricating a mold for an aspherical microlens array, said method comprising the steps of:

(a) forming a protruding microstructure on a substrate;

(b) forming an aspherical-profile forming layer on the substrate

and the protruding microstructure, an aspherical profile being formed on the protruding microstructure utilizing a surface tension of the aspherical-profile forming layer; and

(c) hardening the aspherical-profile forming layer with the
5 aspherical profile being maintained.

26. A method of fabricating an aspherical microlens array, said method comprising the steps of:

(a) forming a protruding microstructure on a substrate;
10 (b) forming an aspherical-profile forming layer on the substrate and the protruding microstructure, an aspherical profile being formed on the protruding microstructure utilizing a surface tension of the aspherical-profile forming layer; and

(c) hardening the aspherical-profile forming layer with the
15 aspherical profile being maintained, wherein the substrate, the protruding microstructure, and the aspherical-profile forming layer are formed of transparent material, respectively.

27. An aspherical microstructure comprising:
20 a substrate;
a protruding microstructure formed on said substrate; and
an aspherical-profile forming layer formed and hardened on said substrate and said protruding microstructure, an aspherical profile being formed on said protruding microstructure utilizing a surface tension of
25 said aspherical-profile forming layer.

28. The aspherical microstructure of claim 27, wherein said

substrate is a substrate with a conductive portion, and said protruding microstructure is an electroplated or electrodeposited layer.

29. The aspherical microstructure of claim 28, wherein said
5 electroplated or electrodeposited layer has one of an approximately-semispherical shape and an approximately-semicylindrical shape.

30. The aspherical microstructure of claim 27, wherein said
10 protruding microstructure is a reflow layer subjected to a reflow-processing.

31. The aspherical microstructure of claim 30, wherein said reflow layer subjected to the reflow-processing has one of an
15 approximately-semispherical shape and an approximately-semicylindrical shape.

32. The aspherical microstructure of claim 27, wherein a plurality of said protruding microstructures are formed on said substrate.

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33. The aspherical microstructure of claim 32, wherein said plurality of said protruding microstructures have a common profile.

34. The aspherical microstructure of claim 32, wherein said
25 plurality of said protruding microstructures are regularly arranged.

35. The aspherical microstructure of claim 27, wherein said

protruding microstructure has one of an approximately-semispherical shape and an approximately-semicylindrical shape.

36. The aspherical microstructure of claim 32, further comprising a fly-eye forming layer formed on said aspherical-profile forming layer
5 to form a fly-eye construction on said plurality of said protruding microstructures.

37. The aspherical microstructure of claim 36, wherein said fly-eye forming layer is formed until a fill-factor of the fly-eye construction
10 reaches approximately 100%.

38. The aspherical microstructure of claim 27, wherein the substrate, the protruding microstructure, and the aspherical-profile forming layer are formed of transparent material, respectively.
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39. A mold for an aspherical microstructure array, said mold comprising:

a substrate;

a protruding microstructure formed on said substrate; and

20 an aspherical-profile forming layer formed and hardened on said substrate and said protruding microstructure, an aspherical profile being formed on said protruding microstructure utilizing a surface tension of said aspherical-profile forming layer.

25 40. A mold for an aspherical microlens array, said mold comprising:

a substrate;

a protruding microstructure formed on said substrate; and

an aspherical-profile forming layer formed and hardened on said substrate and said protruding microstructure, an aspherical profile being formed on said protruding microstructure utilizing a surface tension of said aspherical-profile forming layer.

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41. An aspherical microlens array comprising:

a substrate;

a protruding microstructure formed on said substrate; and

10 an aspherical-profile forming layer formed and hardened on said substrate and said protruding microstructure, an aspherical profile being formed on said protruding microstructure utilizing a surface tension of said aspherical-profile forming layer, wherein said substrate, said protruding microstructure, and said aspherical-profile forming layer are formed of transparent material, respectively.

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